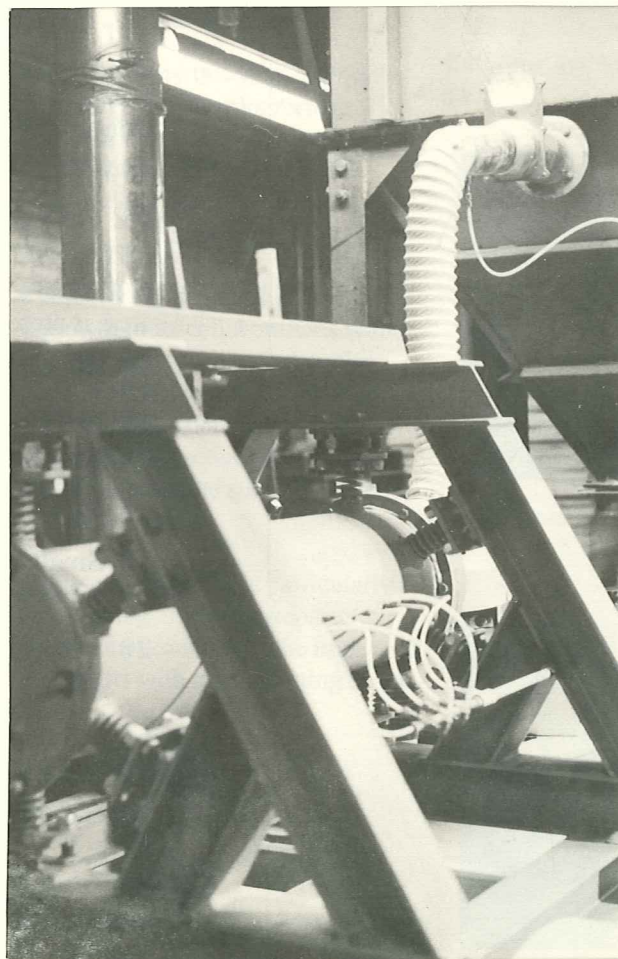
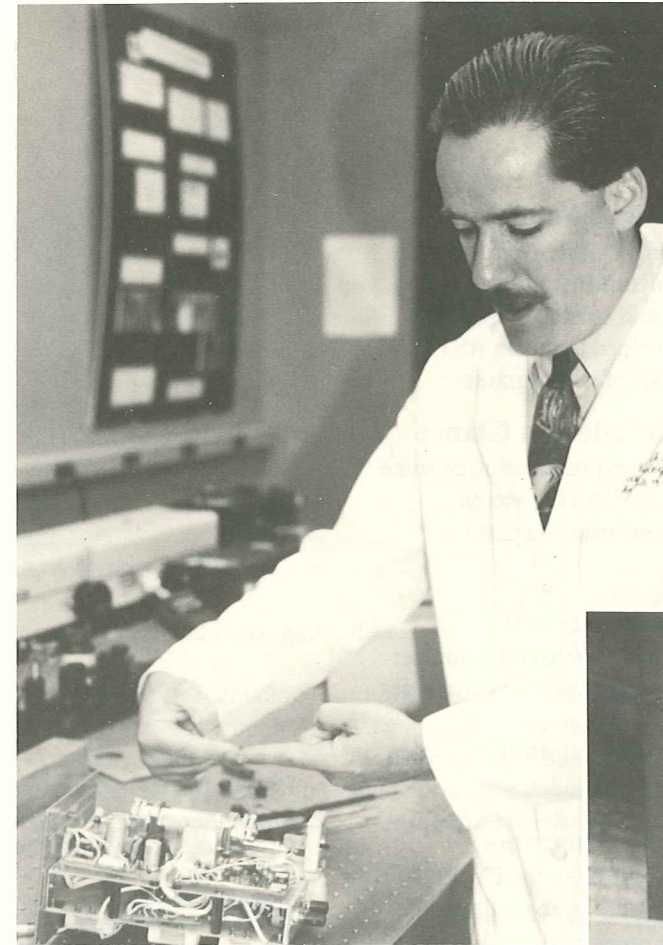


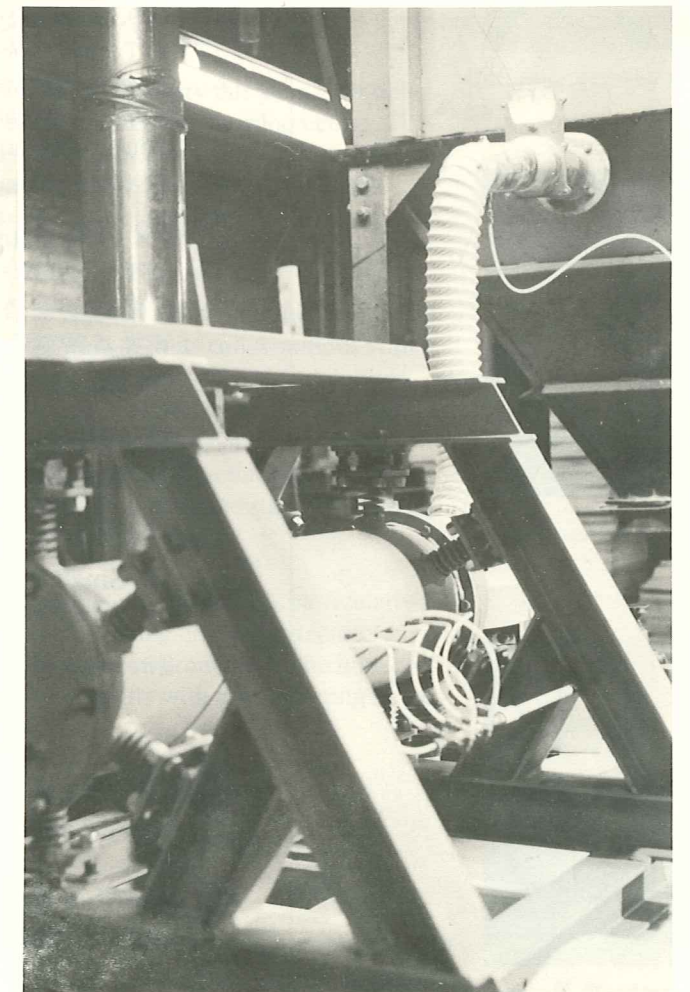
Arkansas
Science
& Technology
Authority
FY 1993
Annual Report



THE FIRST TEN YEARS
1983 - 1993



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THE FIRST TEN YEARS
1983 - 1993



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Photo Captions

Cover: A prototype development of the Vibro Kinetic Energy Mill, a Creative Engineering, Inc. innovation, which produces fine particles for such industries as mining, pharmaceuticals and cosmetics, among others.

Inside Cover: Dr. Stephen Flock of UAMS describes the interior configuration of the Russian Laser Skin Perforator prototype, an energy-related technology development project.

Page 10: Dr. David Kreider of the University of Arkansas Animal and Poultry Science Department received \$6,500 for his applied research study, which could lead to increased litter size in sows and gilts. Matching funds for this project were provided by the Arkansas Pork Producers Association.

Page 13: Tanya Hagler of ASU received an EPSCoR Traineeship for her study of Scientific Models for Multi-Metal Catalyst Systems.

Page 14: Gary Dowdy, President of Intelc Systems Corporation, and staff engineers discuss plans for a barcoding project.

Page 21: Students participating in the Lakeside High School VIE Program in Lake Village perform an exercise to familiarize themselves with laboratory apparatus.



ARKANSAS SCIENCE & TECHNOLOGY AUTHORITY

November 1, 1993

Governor Jim Guy Tucker
Members of the 78th General Assembly
State Capitol
Little Rock, Arkansas 72201


Dear Governor Tucker and Distinguished Legislators:

The Arkansas Science & Technology Authority celebrated its tenth anniversary this year. Not only was this a time for reflecting upon ASTA's many achievements in research and development, technology transfer, small business assistance, and math and science education and improvement, but it also provided an opportunity to evaluate priorities and programs, in an effort to more effectively address and carry out its mission: *to bring the benefits of science and technology to the state and people of Arkansas.*

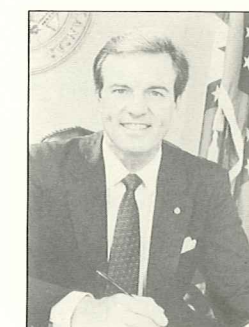
This has been an active and successful year to that end. We have enjoyed a growth in numbers and diversity of projects and proposals. ASTA has also experienced a growth in its collaborations with Arkansas research entities and institutions, businesses and industry, and other private and public entities. We introduced the Ventures In Education Program, a program aimed at facilitating math and science achievement in underrepresented students, to over three hundred Arkansas students. We awarded over \$1 million in grants this year to support Arkansas research and technology development and helped to obtain matching dollars for a variety of projects throughout the state. We also helped to bring the Arkansas School for Mathematics and Sciences into operation.

We thank you for your continued interest and support of ASTA and its programs. It is particularly gratifying to be recognized by community leaders as a key player in ongoing efforts to prepare Arkansas for the challenges of a highly technological, rapidly changing environment. The impact of these efforts is substantial, and we will continue to build upon these efforts with the beginning of our next decade.

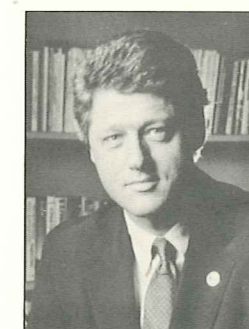
Sincerely,


James K. Hendren, Ph.D.
Chairman of the Board

Arkansas Science & Technology Authority



Governor Jim Guy Tucker



Governor Bill Clinton



James K. Hendren, Ph.D.
Chairman of the Board

" The Arkansas Science & Technology Authority serves as a statewide funding resource for high quality scientific and technological projects. The Authority endeavors to bring the benefits of science and advanced technology to the people and State of Arkansas through scientific research, technology development, business innovation, and education."

ASTA's Mission and Goal

Executive Summary The First Ten Years

The 1993 Legislative Session marked the 10th anniversary of the passage of the enabling legislation that created the Arkansas Science & Technology Authority.

In 1984, ASTA began planning for its future. The Agency began with a magnificent statutory foundation, a staff of four, and not a single program. As a direct result of its strategic planning activities, ASTA was able to make substantial contributions to Governor Bill Clinton's 1985 economic development package. Part of that package, approved by the General Assembly, gave ASTA the major programs in basic and applied research grants, seed capital investments, and technology transfer that it operates today.

As the body of this report documents, some of ASTA's milestones during the past decade include:

- 101 Basic Research Grants awarded, totaling \$3,384,664
- 35 Applied Research Grants awarded, totaling \$850,701
- \$1,500,560 in Seed Capital Investments, with 264 jobs created
- 7 Business Incubators established around the State using different and innovative models; three continue to assist small businesses with modest support from ASTA
- Assistance in establishing the Arkansas School for Mathematics and Sciences
- Involvement with the Arkansas Ventures In Education Program
- Support for Arkansas' Centers for Applied Technology

In recent years, with support from the National Institute of Standards and Technology, ASTA has been deeply engaged in planning efforts to provide manufacturing extension services to the companies that make up Arkansas' industrial base. At the core of this endeavor are ASTA's Technology Transfer and Development Programs, the Arkansas Industrial Development Commission, and the State's college and university-based technology assistance service providers.

The results of these efforts over the past ten years can be measured in terms of job creation, industrial competitiveness and development of the state's scientific and technological base. This is clearly evidenced by the many successful projects funded by ASTA, which have more than doubled the return on each dollar invested.

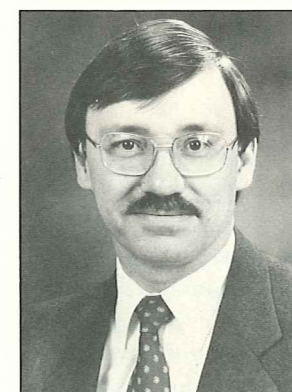
Much of this success can be attributed to ASTA's dedicated staff and its governing Board of Directors, past and present. This eleven-member board makes all decisions regarding the allocation of funds under ASTA's programs such as Basic and Applied Research Grants and Technology Development. Recommendations are made to the Board by two standing committees made up exclusively of members of the Board. These committees deal with scientific research and technological innovation and development.

The mission of the Arkansas Science & Technology Authority is clear: to bring the benefits of science and technology to the people of Arkansas. In the ten years since

its inception, ASTA has maintained a strong commitment to fulfill this mission through its many programs and projects. Despite modest funding, this independent state agency has been recognized as a national model for research and technology-based economic development.

In light of ASTA's status as a leader in scientific and technology promotion, and in celebration of our 10th anniversary, we are reminded of those who have helped along the way. For those who worked to bring ASTA into existence, as well as those who offered continued support to ASTA's many programs and projects ...we salute you.

As ASTA begins its next decade, it will continue to strive to carry out its mission in an effort to bring the benefits of scientific and technological innovation to the state and people of Arkansas. This purpose is as relevant today as it was when the 74th General Assembly created this agency ten years ago.



John W. Ahlen, Ph.D.
President

" Some States, and some governors, have been able to integrate universities, industries, and state policies in a package of technological innovation and competition that is quite impressive. It shows a greater awareness of the way the world is going than you find in many places in Washington. It's where the action is in many key sectors."

Frank Press, President
National Academy of
Sciences

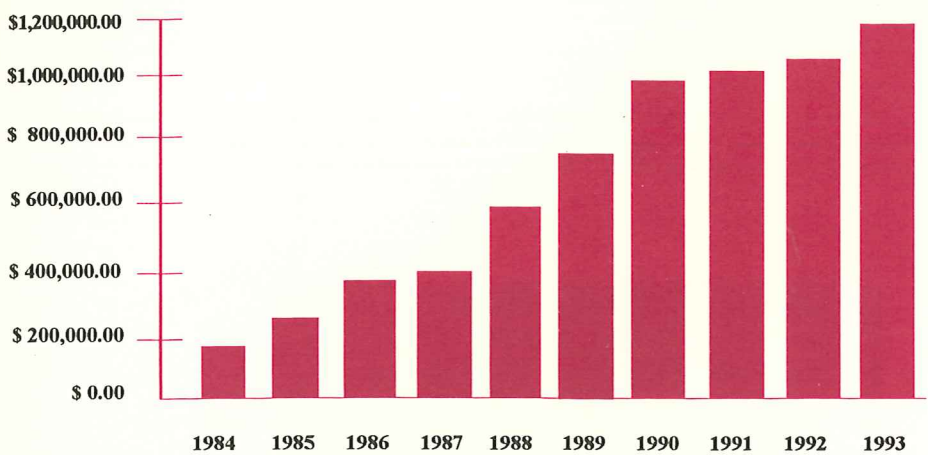
1983 - 1993 The Decade at a Glance

1983

1984

■ The 74th General Assembly passed legislation creating the Arkansas Science & Technology Authority.

General Revenue Expenditure History for ASTA



1983 - 1993
The Decade at a Glance

ASTA - Funded Research Projects

Fiscal Year	Applied Research Projects	ASTA Grant Award	Basic Research Projects	ASTA Grant Award	Energy Related Projects	ASTA Grant Award
1986/87	7	\$246,867	18	\$621,362		
1988	7	177,943	6	238,256		
1989	10	197,591	14	450,062		
1990	3	83,443	13	430,921		
1991	3	69,507	16	545,940		
1992	2	24,000	14	515,169	*1 (year)	*\$250,000
1993	3	51,350	20	582,954	*1 (year)	*\$250,000
Totals	35	\$850,701	101	\$3,384,664	*2 (year)	*\$500,000

* Matching funds for 20 DOE/ASTA EPSCoR Traineeships (\$500,000)

1985

■ Part of Governor Bill Clinton's Economic Development Package gave ASTA its programs in Research, Seed Capital, and Technology Transfer that it operates today.

1986

■ GENESIS, the State's first incubator, opened at U of A, Fayetteville.
■ Arkansas named outstanding western state for financial programs assisting technology-based small businesses.

1987

■ ASTA co-sponsored "Winning the Race With Change," a conference on the role of science and technology in Arkansas' economic development.
■ Small Business Innovation Research Awareness Program (SBIR) established.

1988

■ ASTA assisted several of the 11 economically-distressed counties targeted by Governor Clinton's Rural Development Action Program in drafting economic development plans.

Sample Success Stories

Engineering Resources, Inc.

Engineering Resources, Inc., a biotechnology research and development company, is an example of what ASTA's Incubator Program strives to accomplish: providing resources to foster and support, in cooperation with colleges and universities, the development of technology-based enterprises. The company, which has been a client of the University of Arkansas' GENESIS business incubator for the past three years, uses biotechnology and research to create valuable chemical products using waste materials. The company's success has prompted its \$2 million investment in facilities and equipment to locate in Fayetteville's industrial park.

Venisect, Inc.

Venisect Inc., is a central Arkansas company involved in the effective transfer of biomedical technology between American scientists and their counterparts in the former Soviet Union. Based on research conducted at the University of Arkansas for Medical Sciences by this international team of scientists, the company developed the laser skin perforator, a device that allows the skin to be punctured without the use of sharp instrumentation. The procedure works on the same non-invasive principle now commonly employed in laser surgery involving the eye. Using an intensive light flash, the device creates a laser beam that focuses its lens on a small spot targeted for puncture. The resulting perforation is large enough for sufficient blood collection for most commonly performed blood tests. The benefits of this device include a decreased health risk associated with contaminated needles, which lessens the risk of HIV and hepatitis transmission, a more cost effective method of obtaining blood (nearly fifty times cheaper than instruments traditionally used), and a reduction in the disposal of biologically hazardous wastes.

Fall Green Spinach

Two ASTA grants totaling \$99,220 resulted in the development and commercial release of Fall Green Spinach, a variety with great resistance to disease and environmental stress. The success of this variety has been demonstrated by one spinach processor, which has planted 100 percent of its crop with Fall Green for the last two Fall seasons without the application of any fungicide. It is estimated that this variety has resulted in about 600 Arkansas jobs. This success has led to the development of a similar flat leaf variety of spinach, which provides the same disease resistance. This second variety is expected to be released within the next couple of years. The grants were matched by a \$164,000 contribution from Allen Canning Company of Siloan Springs.

General Electric Motor Company

The General Electric Motor Company, a major employer in Northeast Arkansas, was concerned about productivity and waste minimization within its die casting department. Due to the complexity of the equipment, operation depends on many parameters, which must be monitored by highly-skilled, highly-trained operators and maintenance personnel. The number of parameters, in combination with environmental conditions, create a stressful working situation. Using grant awards from ASTA, the National Institute of Standards and Technology (NIST), and other sources, the company was able to develop a prototype *real time system* to monitor the die cast control parameters and help to troubleshoot the process. The state-of-the-art technology developed as a result of this project can assist operators in identifying and solving operational and technological difficulties during the process.

1989

■ The Centers for Applied Technology Program established to support the National Science Foundation EPSCoR Program.
■ ASTA's Technology Development Program established.

1990

■ The Centers for Applied Technology provided matching funds to create first three centers.

1991

■ ASTA created the Challenge Grants Project, granting qualified industrial networks one dollar for every dollar provided by industrial members to start a network.

1992

■ Ventures In Education Project initiated in Arkansas with a summer orientation program for 328 Delta students.

" Arkansas can carve out a unique place for itself in the Nation if, in establishing its research and development goals, particular attention is given to the future needs of the Country and how Arkansas can combine its own special resources and capabilities to arrive at innovative means of meeting those needs. "

Report of the
Legislative Task Force,
January, 1983

1993 and Beyond The Challenge

The pace of change has accelerated at an alarming rate. The economic impact of advances in space technology, superconductivity, biotechnology and telecommunications is already far-reaching. ASTA recognizes that the ultimate test of any state's economic development and restructuring efforts will be how effectively it meets the new technological demands. The question remains: *Is Arkansas Ready?*

ASTA believes that further growth and development of its research and development programs remains a high priority. The excerpt at left, taken from the 1983 Report of the Legislative Task Force, directs Arkansas to engage in long-term planning and goal-setting in the areas of science and technology development in an effort to compete.

ASTA has formulated long-term goals as follows: (1) to increase per capita research and development funding at colleges and universities by (a) increasing the national competitiveness of Arkansas scientists and (b) building a critical mass of research strength in the state; (2) to improve employment, long-term employment growth, long-term job security, and per capita income by increasing the number of scientists and engineers in the workforce through increased investments in basic and applied research, technology-development and technology-based enterprises; and (3) to enhance Arkansas' educational base by increasing support for math, science, and engineering at all levels.

To achieve these goals, ASTA's Board of Directors has adopted a plan that outlines present and future program strategies as well as indicators for measuring project and program impact.

RESEARCH

Meeting the technology needs of U.S. businesses begins with maintaining a strong and broad research base. In the increasingly competitive environment of the new economy, Arkansas must learn to use its research strengths to create commercial advantages.

ASTA's Basic and Applied Research Grants Programs competitively fund original investigators for the discovery and application of scientific and engineering knowledge. ASTA will continue to direct more public and private resources toward market-driven research through the following strategies:

- to use state funds as an incentive to get scientists active in new and applied areas of research, provide them with the beginning of a track record, help them become nationally competitive, and bring more research funds to the State
- to use state matching funds as an incentive to encourage partnerships with industry, provide industry with new technology that secures and expands employment, and build the capacity to rapidly commercialize research results

- to build a critical mass of research strength in selected disciplines and complement it with efforts to turn research results into innovative products and new processes

DEVELOPMENT

Continuing experience in dealing with inquiries from inventors, scientists, and business owners with new product plans, confirms the desperate need for a program to support development of new ideas into products.

The purpose of the Technology Development Program is to support development of innovative technology through funding of projects from the lab/workshop stage to full-scale production model development. This can be useful in raising investment capital and licensing new technology to an existing company. ASTA has formulated a number of strategies to expand development. These include:

- to use state funds as an incentive to develop prototypes and to protect intellectual property. New business opportunities with related employment and growth potential should result, and feed into other state-supported business assistance programs
- to promote awareness of the federal Small Business Innovation Research (SBIR) Program and provide information to small businesses which seek to submit proposals. This will increase the amount of federal R & D funds coming into the State

- to use public funds to invest in the innovative technology of Arkansas enterprises and serve as an incentive for technology and business development in Arkansas

ADVOCATING EDUCATION

Leadership in a technologically advanced economy will require that workers be technologically literate, imaginative and adaptable to rapid change. It will also require a large contingent of highly-skilled, technologically trained workers. A prepared workforce will be Arkansas' most critical asset when competing in the commercialization of new technologies. Long-range strategies in this area include:

- to bring together small companies from the same region and within the same industry for mutual support and economies of scale
- to improve primary and secondary science education through the Ventures In Education Project, and support of the Arkansas School for Mathematics and Sciences

The Arkansas Science & Technology Authority recognizes the barriers to developing and commercializing new technologies into successful products. Obtaining adequate funding at all stages of research and development is perhaps the biggest challenge. ASTA will strive to seek new funding sources for its many programs, which will, in turn, generate and promote economic growth within Arkansas.

" All major sectors of society - government, industry, academia, nongovernmental organizations, and the public - have key roles to play in the process of setting long-term science and technology goals. Scientists alone cannot develop these goals; a coordinated effort by a cross-section of society is essential. "

H. Guyford Stever,
former Director of the
National Science
Foundation, from the
Concluding Report of
the Carnegie Commission on Science.

" All institutions generate new knowledge, but universities, national and federal laboratories, and industrial research laboratories are best known for this capability. What these institutions need to know is - what are industry's needs? What industry needs to know is - how can these institutions help solve industrial problems?. "

1988 Report of the House of Representatives Technology Task Force, Committee on Science, Space, and Technology

FY1993 Programs Research

The Basic and Applied Research Grants Programs competitively fund original investigations for the discovery and application of scientific and engineering knowledge. Response to and success of these programs has been exceptional. Since its inception in July 1985, the Basic and Applied Research Grants Programs have received 476 proposals and have funded 136, totaling \$4,235,365, and affecting nine Arkansas universities.

Most projects have a direct, long-term effect on the economic vitality of the State of Arkansas. These projects also provide opportunities for other technology development and business innovation programs.

Basic Research

Basic research is the theoretical and experimental investigation to advance scientific knowledge. And while it is often directed toward developing new scientific understanding of a fundamental nature, it is often motivated by and is never far from use in solving practical problems. According to the Montana Science & Technology Advisory Council (1992), essentially all new technological industry springs from basic research.

The goals of ASTA's Basic Research Grants Program are to promote the growth and development of Arkansas scientists and to enhance the status of science and engineering in state colleges and universities.

Historically, projects that have received funding have had strengths in areas as diverse as biology,

molecular biology, plant pathology, genetics, chemistry, paleontology, nonlinear dynamics, environmental science, agricultural engineering and computer science. FY 1993 projects were equally diverse. Twenty basic research grants were awarded this year, totaling \$582,954. These projects represented the work of a cadre of fine researchers from six Arkansas universities.

Applied Research

Applied research also plays a vital role in the economic development of Arkansas. It is the key to technological advancement, because it uses scientific knowledge gained in basic research to create situations that serve a practical purpose.

ASTA's Applied Research Grants Program is a cost-sharing grant program that supports science and engineering research. The goal of the program is to stimulate the transfer of science and technology in Arkansas by enhancing opportunities for research partnerships between Arkansas colleges and universities and private industry.

Three applied research grants were awarded in FY 1993, totaling \$51,350, and drawing \$56,000 in industry co-sponsor matches. These projects directly benefit the industry co-sponsor by saving or creating industry jobs. To encourage investment in the Applied Research Grants Program by Arkansas industry and business, co-sponsors are eligible for Arkansas state income tax credits through ASTA's Research and Development Tax Credit Program.

Applied Research Projects Awarded in FY 1993

Project	Investigators/University	Industry Co-Match	ASTA Award
Forage Affected by Swine Lagoon Effluent	Dr. J.M. Phillips (UAF)	Arkansas Pork Producers Tyson Foods, Inc. Cargill, Swine Products	\$20,400
Rice Proteins in Foods	Dr. Patti Landers and Dr. Roy N. Sharp (UAF)	Rice Research & Promotion	\$12,500
An Investigation of Factors Which Lead to Ascites in Broilers	Dr. Walter Bottje (UAF)	Arkansas Poultry Federation	\$18,450
TOTAL			\$51,350

Basic Research Projects Awarded in FY 1993

Project	Investigator/University	ASTA Grant Amount
■ Carbon Partitioning in Loblolly Pine Seedlings	Dr. J. Brad Murphy (UAF)	\$35,550
■ GnRH Treatment on Postweaning Reproductive Performance	Dr. R.W. Rorie (UAF)	\$19,360
■ Arginine Vasotocin Gene Expression in Chickens	Dr. Thomas I. Koike (UAMS)	\$29,960
■ Human CD30 Antigen Gene	Dr. Pei-Ling Hsu (UAMS)	\$31,000
■ Molecular Cloning of Cockroach Allergens	Dr. Rick M. Helm (ACH)	\$30,000
■ Oligosaccharide Attachment to Staphylococcal Nuclease	Dr. Wesley E. Stites (UAF)	\$33,800
■ Representations, Resolutions, and Determinantal Ideals Associated to the Classical Group	Dr. Mihalis Maliakas (UAF)	\$ 9,506
■ Learn a Language in (almost) Zero Minutes a Day: A Computer Assisted Instruction System	Dr. Daniel Berleant (UAF)	\$24,460
■ Hemophilia Treatment: Factor VIII Secreting Skin Grafts	Dr. Paul L. Hermonat (UAMS)	\$32,085
■ Protein DNA Interactions in the Promoter of LDL Receptor Gene	Dr. Kamal D. Mehta (UAMS)	\$27,870
■ High Pressure Brillouin Scattering in Condensed Matter Systems at High and Low Temperature	Dr. William F. Oliver, III (UAF)	\$50,000
■ Study and Development of Semiconductor Lasers Utilizing Grating External Cavity Strong Feedback	Dr. Steven Menhart (UALR)	\$34,510
■ Looking for New States of Matter Using Ultra-Relativistic Heavy Ions	Dr. Wilfred J. Braithwaite (UALR)	\$24,160
■ Grass Cell Wall Characteristics and Ruminant Energy and Nitrogen Metabolism	Dr. Arthur L. Goetsch (UAF)	\$35,300
■ Coordinated Astrocytic and Neuronal Calcium Activities	Dr. Roger A. Buchanan (ASU)	\$35,500
■ Phylogenetic Relationships Between Polydnnaviruses and Glyptapanteles Parastoid Wasps	Dr. James B. Whitfield (UAF)	\$26,000
■ Production of Transgenic Spinach Resistant to Infection by Cucumber Mosaic Virus (CMV)	Dr. Edwin J. Anderson (UAF)	\$35,000
■ Function of Bacteriophage ϕ X174A* Protein <i>in vivo</i>	Dr. Bentley A. Fane (UAF)	\$27,400
■ Modeling, Parameter Estimation, and Control of Periodic Structures	Dr. Robert E. Miller (UAF)	\$16,193
■ Alumina Supported Catalytic Membranes of Aluminum Phosphate and Boron Phosphate	Dr. David Lindquist (UALR)	\$25,300
TOTAL		\$582,954



Energy Research

Energy resources have played an important part of both the domestic and global economies in the past several decades. This trend is expected to continue as the demand for high-quality, cost-effective energy products increases.

Other issues in the energy industry relate directly to government policy in the areas of commerce and transportation, defense, environmental concerns and international trade. States must be prepared to address these new demands for energy in order to compete.

Recognizing the economic importance of energy resources, the Experimental Program to Stimulate Competitive Research (EPSCoR), in conjunction with ASTA, awarded 20 Department of Energy/ASTA Traineeship Grants to graduate students in energy-related fields of study.

Departments at three Arkansas institutions submitted proposals for traineeships in FY 1993. These proposals were from the University of Arkansas, Fayetteville, the University of Arkansas at Little Rock, and Arkansas State University.

Each of the \$25,000 traineeships awarded consists of a \$21,000 annual stipend, \$3,000 for tuition and fees, and \$1,000 for travel and publication-related costs. The traineeships enhance the energy-related research, resources and infrastructure of the State.

DOE/ASTA EPSCoR Traineeships Awarded in FY 1993

Project	Professor/University	Grantee
■ Heat Transfer Characteristics of Solar Siding	Rick Couvillion (UAF)	Melinda Palmer
■ Scientific Models for Multi-Metal Catalyst Systems	Mark Draganjac (ASU)	Tanya Hagler
■ Quantification of the Effect of Drying Air Conditions on Drying Rate of Rice and Resultant Kernel Quality	T.J. Siebenmorgen (UAF)	Cheryl Schulman
■ Structure/Function Relationships in Proteins Involved in Photo-Synthesis	D.J. Davis (UAF)	Marti Scharlau
■ Investigation of Intra-Cavity Laser Raman Spectroscopy on Distillates of Hydrocarbon Fractions	M.K. Hudson (UALR)	Kathy Underhill
■ Study of Fluorinated Hydrogenated Amorphous Silicon Nitrogen Alloy for High Efficiency Multijunction Solar Cells	H.A. Naseem (UAF)	Steven Kizzar
■ Evaluation of Inorganic Thin Films as Corrosive Protective Barriers for Multichip Modules (6 month award)	R.K. Ulrich (UAF)	David M. Nelms
■ Develop Instrumentation and Methodology for Inexpensive Detection of NO _x and SO ₂ in the Flame of Burners	Keith Hudson (UALR)	Diana Linquist
■ Structural Studies of Molecular Conductors	A.W. Cordes (UAF)	Clinton Bryan
■ Study of Fluorinated Hydrogenated Amorphous Germanium Carbon Alloy for Multijunction Solar Cells	Simon Ang (UAF)	Paul Moffitt
■ Study of Fluorinated Hydrogenated Amorphous Silicon Germanium Alloy for Multijunction Solar Cells	W.D. Brown (UAF)	Warren K. Harper
■ Harmonic Impact of Photovoltaic Inverter Systems Used for Bulk Power Generation in Electric Power Systems	Kraig Olejniczak (UAF)	David G. Daniels
■ Materials Compatibility in Superconducting Multi-Chip Modules	R.K. Ulrich (UAF)	James D. Palmer
■ Optical Characterization of High Temperature Superconductor Films	Greg Salamo (UAF)	Steven E. Elkins
■ Optical Characterization of Diamond Films for Superconductor Multichip Modules	Min Xiao (UAF)	Diane Bootz
■ Development of an Improved Gas/Steam Turbine Seal	Matthew Gordon (UAF)	Christopher Kopp
■ Production of Methane from Cellulosic Materials by Anaerobic Fermentation	James Moore (UAF)	Matthew Taylor
■ Instrumenting the STAR Detector for the Relativistic Heavy Ion Collider	Andre Rollefson (UALR)	Douglas Mauldin
■ Design Studies for Investigating Coherent Pions	W.J. Braithwaite (UALR)	Charles Byrd
■ High Temperature Flue Gas Cleaning with Ceramic Granular Filters	M.K. Mazumder (UALR)	Chien Wang

" If you don't have any technological or research capability, you may be at the mercy of those who produce the parts, and you may not even be in a position to accurately describe what it is you want them to do. "

Robert A. Frosch,
Vice President,
GM Corporation, 1987

FY1993 Programs EPSCoR / Centers For Applied Technology

EPSCoR Program

The Federal Experimental Program to Stimulate Competitive Research (EPSCoR) was initiated in 1978 by the National Science Foundation to assist states in competing for federal research support.

The Arkansas EPSCoR Committee, created in 1979, strives to draw public attention to the need for increased state support of science and technology. The Committee has a number of functions, including oversight of the Department of Energy/ASTA Traineeship Awards, and the EPSCoR programs of the Departments of Energy, Environmental Protection Agency, and the National Science Foundation.

The Committee also serves as a liaison with the National Aeronautics and Space Administration - Space Grant Consortium, composed of representatives of seven Arkansas colleges and universities that received NASA funding.

A number of other federal agencies maintain EPSCoR-like programs: the Departments of Agriculture (USDA), Defense (DOD), Energy (DOE), and Transportation (DOT), the Environmental Protection Agency (EPA), the National Science Foundation (NSF), National Institutes of Health (NIH), and the National Aeronautics and Space Administration (NASA).

The Arkansas EPSCoR Committee has continued to develop proposals for a number of these EPSCoR programs. This year, the Arkansas EPSCoR Committee submitted a proposal to the Department of Energy Program that provides

\$625,000 per year to three different states.

Arkansas' proposal includes the development of three new research centers at the University of Arkansas, Fayetteville; the University of Arkansas for Medical Sciences; and Arkansas State University. The projects are based on Photovoltaic Energy Research, High Energy Nuclear Physics, and Energy-Related Biological Stress. There is a dollar-to-dollar match required, but in-kind and indirect costs can be used as this match.

The impact of the EPSCoR programs on the State's research and development efforts is far-reaching. In particular, these centers assist in the creation of new firms through the development and enhancement of products and processes, attracting new industries to Arkansas, and enhancing competitiveness of existing industries through the application of advanced technology.

Participation in these programs is increasingly consistent with university research agendas. The quality of projects is assured by the federal agency review process.

However, the sole limiting factor to the continued success of these programs seems to be the availability of state matching funds, the demand for which is expected to increase as more federal agencies initiate EPSCoR - like programs. The challenge before ASTA and the Arkansas EPSCoR Committee appears to be identifying longer-term sources for matching funds.

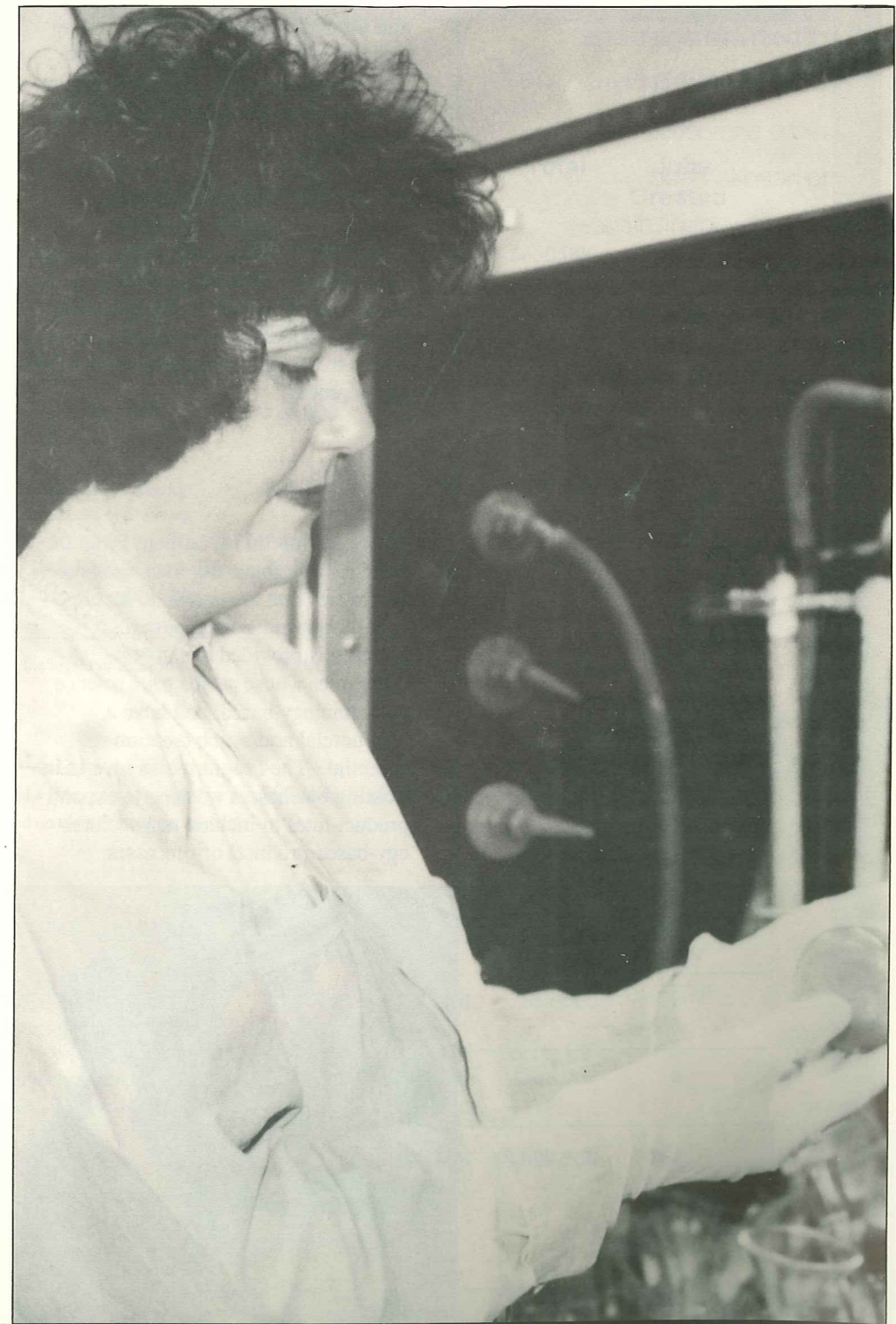
Centers for Applied Technology

ASTA's Centers for Applied Technology Program was established in 1989 to encourage collaborations between institutions of higher-learning and public and private enterprises. The collaborations are intended to speed the discovery, development and application of new technology.

Since 1990, the Centers Program has provided matching funds to establish a total of five research and technology centers:

- The Center for Protein Dynamics at the University of Arkansas, Fayetteville
- The Arkansas Neurobiology Research Center at the University of Arkansas for Medical Sciences
- The Center for Cellular and Molecular Studies on Biological Aging at the University of Arkansas for Medical Sciences
- The Center for Materials Handling at the University of Arkansas, Fayetteville
- The Space Grant Consortium, including seven Arkansas universities

The Arkansas Space Grant Consortium (ASGC) provides an introduction and training for faculty and students on aerospace fundamentals and NASA's research programs. This program was established through a grant from NASA.



" In the 21st Century, comparative advantage will be determined by mastery of high tech processes and by the knowledge and skills of both managers and workers. A shift from niche competition to head-to-head competition will dictate the rules of the new economic game - a mix of world cup soccer and world-class chess, for which Americans, in particular, are unprepared. "

Lester C. Thurow
Dean of the MIT Sloan
School of Management, 1991

FY1993 Programs
Development

The commercialization of technology and innovation cannot be achieved by research alone. Converting research results and ideas into useful products is a necessary, if not essential step, in the process.

ASTA's Development Programs include seed capital investment, technology transfer, technology development and small business assistance, all aimed at strengthening the effectiveness of Arkansas businesses in new product and process development.

Seed Capital

The Seed Capital Investment Program provides risk financing to early-stage companies that are unable to secure funds from traditional sources. Funding is provided to start-up companies whose projects are science or technology-based, and have a commercial and/or job creation potential. The Program also invests in existing businesses wanting to expand product lines to include new technology-based products or processes.



The Seed Capital Investment Program is one of ASTA's original programs and has made ten investments since its inception. In FY 1993, ASTA invested in three Arkansas companies. Intelec Systems Corporation, established in 1988, received \$50,000 in seed capital funding in December 1992. This Little Rock company employs ten and is a reseller and integrator of automated identification and data collection systems that utilize bar coding technology.

A second investment was awarded to Hydro-Temp Corporation of Pocahontas. The company holds a patent for its development of an integrated heat pump for space heating and cooling and residential hot water needs.

A third investment was awarded to Earthcare Systems, Inc., a Fayetteville company that has developed a natural process to control waste. This unique proprietary technology accelerates the decomposition of organic materials into an environmentally sound compost that restores soil structure and replenishes soil nutrients.

Unlike other ASTA programs, the Seed Capital Investment Fund (a cash fund) received a one-time appropriation of \$1.8 million in 1985 from interest on the general revenue fund. Because of the limited size of the investment fund, the program uses each dollar to leverage 3 dollars in matching funds. Investments have totaled \$1.5 million and have leveraged an additional \$6.6 million from other sources since 1985. In addition, these investments have helped businesses to create over 264 new jobs in Arkansas.

Seed Capital Investments:
Indicators of Success

Company	Project	ASTA Award	Matching Funds	Total	Jobs Created
ARTECH 1986, Clarksville	High-tech production equipment which enhances manufacturing productivity	\$150,000	\$500,000	\$650,000	41
MICOIL 1988, Conway	Thin-film inductor coils for electronics industry manufactured with laser tech.	150,000	550,000	700,000	0
NTHOGRAPHY 1988, Fayetteville	Low-altitude, remote-controlled photography devices	125,000	225,000	350,000	0
ARTEK SYSTEMS 1990, Fayetteville	Wide-area bar code readers used by US Post Office to speed mail sorting	175,000	1,175,000	1,350,000	0
TRANSGENIC SCIENCES, INC. 1990, Redfield	Develop toxicology tests and disease models based on genetic engineering	250,000	1,500,000	1,750,000	20
LAW OFFICE INFORMATION SYSTEMS, INC. 1991, Van Buren	Software for the legal community	200,000	480,000	680,000	100
■ EMERGING TECHNOLOGIES, INC. 1989, Little Rock	Sporting good sights and audio-visual pointers based on world's smallest laser	200,000	1,050,000	1,250,000	53
■ INTELEC 1993, Little Rock	Automatic identification using bar code technology	50,000	148,000	198,000	10
■ HYDRO-TEMP 1993, Pocahontas	Produces earth coupled heat pumps for space heating and cooling	50,560	537,000	587,560	32
■ EARTHCARE 1993, Fayetteville	Natural, odorless process to control waste and create enriched compost	150,000	415,000	565,000	8
Total Project Financing		\$1,500,560	\$6,580,000	\$8,080,560	264

■ indicates active portfolio companies

" Technology is not a ' thing ' but a dynamic process involving the application of knowledge, resources, and technique to problem solving. It is not simple or neat, nor does it happen in only one way. Technology emerges not only from the laboratory and university, but also from the manufacturing process. Often technology is born on the factory floor. "

Lewis B. Kaden, as
Chairman of the Cuomo
Commission on Trade
and Competitiveness, in
the Cuomo Commission
Report, 1988

Technology Transfer

Technology transfer programs facilitate the transmission of new technologies from the laboratory to the private sector. These technologies can become the impetus for the creation of new businesses, the introduction of new product lines for established firms, or the revitalization of mature industries. Technology Transfer is achieved through information exchange and active outreach programs that seek users for existing and newly-developed technologies.

ASTA's Technology Transfer Program has provided, since its establishment in 1985, a link between the technological resources of the state's universities and private enterprises. The primary goal of this service program has been to better prepare Arkansas businesses and industry for competition in a technology-driven society.

The Technology Transfer Program has traditionally functioned through referrals to specific technology development programs at ASTA and to college and university resources. The general strategy has been to facilitate cooperation between public and private entities and to foster early-stage development projects.

Technology transfer can occur at any stage of technology growth, including basic research, applied research, or technology development. Technology transfer can also occur at any stage of business growth including workshop, early start -up or

operations. As a result, many interfaces exist by which innovations can be transferred from ideas into commercialized products.

In an effort to build upon existing interfaces, ASTA has continued to expand its Technology Transfer Program through the development of a statewide technology extension network.

The mission of this network is to enhance Arkansas' small and medium-sized enterprises by assisting with the development and implementation of the best practices available to improve productivity, modernize manufacturing processes, and increase product quality.

The Arkansas Technology Reinvestment Project Coordinating Council, chaired by ASTA and with the Governor's support, began implementation of this network, referred to as the Manufacturing Extension Network, in April 1993. Charters were soon embraced by participating technology assistance service providers and economic development organizations.

ASTA recognizes the need for technology transfer in Arkansas and the availability of useful resources at colleges and universities. It is clear that ASTA will play a pivotal role in this process. As such, ASTA will continue its efforts in facilitating cooperation between university-based resources and Arkansas enterprises and fostering early-stage, business-driven transfer of ideas into commercially-viable products.

Technology Development

The Technology Development Program, established in 1989, supports the development and commercialization of new ideas into products. It does so by using state funds as an incentive for businesses to develop prototypes and to protect intellectual property. Those eligible for the Technology Development Program include qualified researchers at Arkansas colleges and universities, researchers at federal laboratories in Arkansas, Arkansas-based small businesses, and inventors within the state.

In 1991, the program received a \$250,000 grant for energy-related technology development from the Energy Office of the Arkansas Industrial Development Commission/Petroleum Violation Escrow Fund.

Two energy-related investments were approved by ASTA's Board of Directors under this specific allocation. In 1993, a \$50,000 award was made to Creative Engineering Consultants, Inc., of Little Rock for the prototype development of a Vibro Kinetic Energy Mill. Using less energy than other technologies, this innovation produces fine particles for such industries as mining, pharmaceuticals, and cosmetics, among others.

A second project was approved for funding in the amount of \$49,638 for development of an erbium-YAG laser skin perforator. This instrument allows the skin to be punctured without the use of needles or lancets. The concept behind the perforator is the same as that now used in laser eye surgery. A beam of laser light focuses on a small spot creating a tiny

perforation. Blood can be drawn through the perforation, which is then allowed to close and heal. This new technology is being developed by a Little Rock-based company, Venisect, Inc., in cooperation with Russian and American researchers at the University of Arkansas for Medical Sciences.

In 1993, this program received its first state appropriations. The enabling legislation establishes a payback provision for successful technology development projects, which can be funded at a level not to exceed \$50,000. The payback is through a royalty of up to five percent of net sales revenue per year for up to ten years.

According to a Report of the National Governors' Association Task Force on Research and Development (1992), the development of full-scale models and prototypes of new products are the most expensive portion of the commercialization process, requiring both long-term investment and the highest risk of capital. At the same time, U.S. industry's focus is often short-term, based on the quarterly profit and loss statement. In order to compete, businesses and industry will have to be on the forefront when it comes to developing new product lines. This will take substantial investment and sound planning.

With this in mind, ASTA intends to create new business opportunities with related employment and growth potential through technology development. ASTA will assist businesses in long-term technology development planning. Future projects funded through this program should result in opportunities for other state-supported business assistance programs.

" One thing learned is that technology transfer is not a 'piece' of any process. It is not a 'piece' of the research process, or a 'piece' of the manufacturing process. Instead, it is something that must surround all processes like an envelope around a letter. "

John W. Ahlen,
President, Arkansas
Science & Technology
Authority, at a special
conference on technology transfer in the
southern and
appalachian states,
1989

" A healthy and growing small-business sector is essential to America's economic well being. America's 20 millionsmall businesses account for 40 percent of our GNP, half of all employment, and more than half of the job creation. My technology policy will recognize the importance of small and medium-sized businesses to America's economic growth by (1) creating a national technology extension service, and (2) expanding the highly successful Small Business Innovation Research (SBIR) Program. "

Clinton and Gore
Technology Policy,
Final Version, 1992

FY 1993 Programs Small Business Assistance

Emerging technologies will have a tremendous impact on Arkansas industry and business. This impact will be perhaps the greatest on small businesses, which must update and streamline production and services in order to compete with limited financial resources.

ASTA recognizes the increasingly important role that small businesses play in the future economic status of Arkansas and its citizens. ASTA is committed to promoting assistance to small businesses in an effort to meet the demands of future technology.

Business Incubator Program

Incubator facilities provide below-market rates for office and lab space for start-up companies. In addition, these facilities offer shared support for clerical, reception and computer services. Once a company has progressed to a sustainable level, it is expected to leave the incubator in order to allow the facility to accomodate additional start-up companies.

ASTA's Business Incubator Program was established in 1985 to foster, in cooperation with colleges and universities, the development of technology-based enterprises. Since 1986, seven models have been tested and three continue to serve the needs of technology-based businesses throughout the State. These awards include:

- GENESIS: A science and technology economic development project at the University of Arkansas, Fayetteville;

- The East Arkansas Business Incubator System (EABIS) at Arkansas State University in Jonesboro;
- The Institute for New Enterprise Formation at Southern Arkansas University in Magnolia;
- North Arkansas Business Incubator System in Salem, in cooperation with the North Arkansas Community College in Harrison;
- The Industrial Renaissance Center at the University of Arkansas at Monticello;
- The Institute for Innovative Business Development at the University of Arkansas at Pine Bluff; and
- The Technical Enterprise Center at the University of Arkansas at Little Rock.

Approval of the last business incubator in 1990 marked the final maturation of the Incubator Program. In FY 1993, a total of \$100,000 was released from the General Improvement Fund to support, in part, three of the State's incubators. The GENESIS Incubator received \$50,000; EABIS Received \$30,000; and the Industrial Renaissance Center received \$20,000.

ASTA continues to have an interest in better serving the needs of small businesses through a comprehensive business innovation system that uses the resources of the Authority, the Small Business Development Center, the projects funded with the Department of Higher Education's promotional grants, and the Arkansas Industrial Development Commission.

SBIR

The Small Business Innovation Research Awareness Program (SBIR) is designed to assist Arkansas' small businesses in obtaining federal research and development funds that are available through eleven different federal agencies.

Since the federal SBIR Program was established in 1983, over \$4 million in federal research contracts has been won by Arkansas firms. This year, two firms were awarded SBIR grants. Both are tenants of the GENESIS Business Incubator.

Engineering Resources, Inc., received a \$450,000 Phase II award for further development of the bioconversion of coal synthesis gas to fuel oxygenates. A second company, InvoTek, received a \$50,000 Phase I award for the development of a behavior modification monitoring device.

ASTA is continuously seeking ways to promote the SBIR Program to other small businesses around the state.

Arkansas Industrial Network Project

Originally funded by a \$71,440 grant from the Winthrop Rockefeller Foundation, the Southen Technology Council and ASTA organized efforts to form regional networks throughout the state and to bring the benefits of networking to Arkansas' manufacturers. This project resulted in the training of network brokers who would work with small busi-

nesses to establish networks and compete for matching funds under a challenge grant project.

In cooperation with the Southern Technology Council and Winrock International, six network challenge grants have been awarded through this program:

- The Arkansas Enterprise Group (\$20,000) for the Southern Woods Products Association to develop business strategies and provide management services;
- Westark Community College (\$10,000) for the Fort Smith Manufacturing Project to identify furniture/fixture companies, develop a capabilities directory, and identify common problems and opportunities;
- Arkansas State University - Beebe (\$15,000) for a network of three metalworking firms to purchase and share the capacity of a CAD/CAM system;
- Phillips County Community College (\$10,000) for the Delta Safety Network to provide required Department of Labor (DOL) safety training to 12 companies;
- The Metalworking Connection (\$20,000) for a buyer-seller just-in-time inventory system for 57 companies; and
- The Woodworkers Manufacturing Cooperative (\$14,900) for development of a low cost, numerically-controlled router for five companies.

Arkansas Manufacturing Extension Network Project Proposal

The Governor's Technology Reinvestment Project Coordinating Council, in partnership with the Arkansas Science & Technology Authority and the Arkansas Industrial Development Commission, submitted a proposal to the Technology Reinvestment Project (TRP) of the Advanced Research Projects Agency to establish an Arkansas Manufacturing Extension Network.

The Arkansas Manufacturing Extension Network will, with federal funding of the proposal, integrate and coordinate existing, local technology assistance service providers with new statewide capabilities including field and staff engineers, electronic linkages, and evaluation of statewide services.

The newly structured Network will meet the needs of Arkansas' small and medium-sized firms for access to the technology, management, and training necessary to make them world-class competitors. The proposal requests \$1,341,146 in 1993-94 and \$1,221,646 in 1994 - 95 from the federal government during the two-year base period for the Network.

The Technology Reinvestment Project (TRP) grant awards are expected to be announced in the Fall of 1993.

" The Nation can meet future potential shortfalls of scientists and engineers only by reaching out and bringing members of underrepresented groups into science and engineering. "

Task Force on Women, Minorities, and the Handicapped in Science and Technology, Executive Summary, Page 1

FY1993 Programs Science and Mathematics Education and Promotion

In order to prepare Arkansas' children for the future, educators must impart skills in problem solving, critical thinking and communications so that students can, as young adults, adapt to change in an increasingly competitive environment.

ASTA has pledged a strong commitment to serving as an advocate for math and science education throughout the state. In this role, ASTA has been involved in several major education efforts to date.

The Arkansas Ventures In Education Program

The Arkansas Ventures In Education Project promotes the enhancement of science and math education at selected junior and senior high schools in Arkansas' rural Delta counties. The project is promoted by Ventures In Education, a nonprofit organization created by the Josiah Macy, Jr. Foundation.

The Ventures Model combines curriculum enhancement, high quality faculty development, and intensive counseling and career guidance to motivate and prepare students for success in college, post-secondary training and employment.

The Arkansas Ventures In Education Program is funded by the National Science Foundation, and has also received local funding from the Winthrop Rockefeller Foundation, the Coca-Cola Bottlers of Arkansas, Southwestern Bell Telephone Company, and Arkansas Electric Cooperatives Corporation.

In 1992, the Ventures In Education Project was introduced as an Arkansas EPSCoR project spinoff, with a summer orientation program that provided 328 Delta students with experiences focused on career awareness, academic enrichment and leadership development. The project is expected to grow as each new group of entering ninth graders is added, totaling more than 1,300 students by the time the first Ventures class graduates.

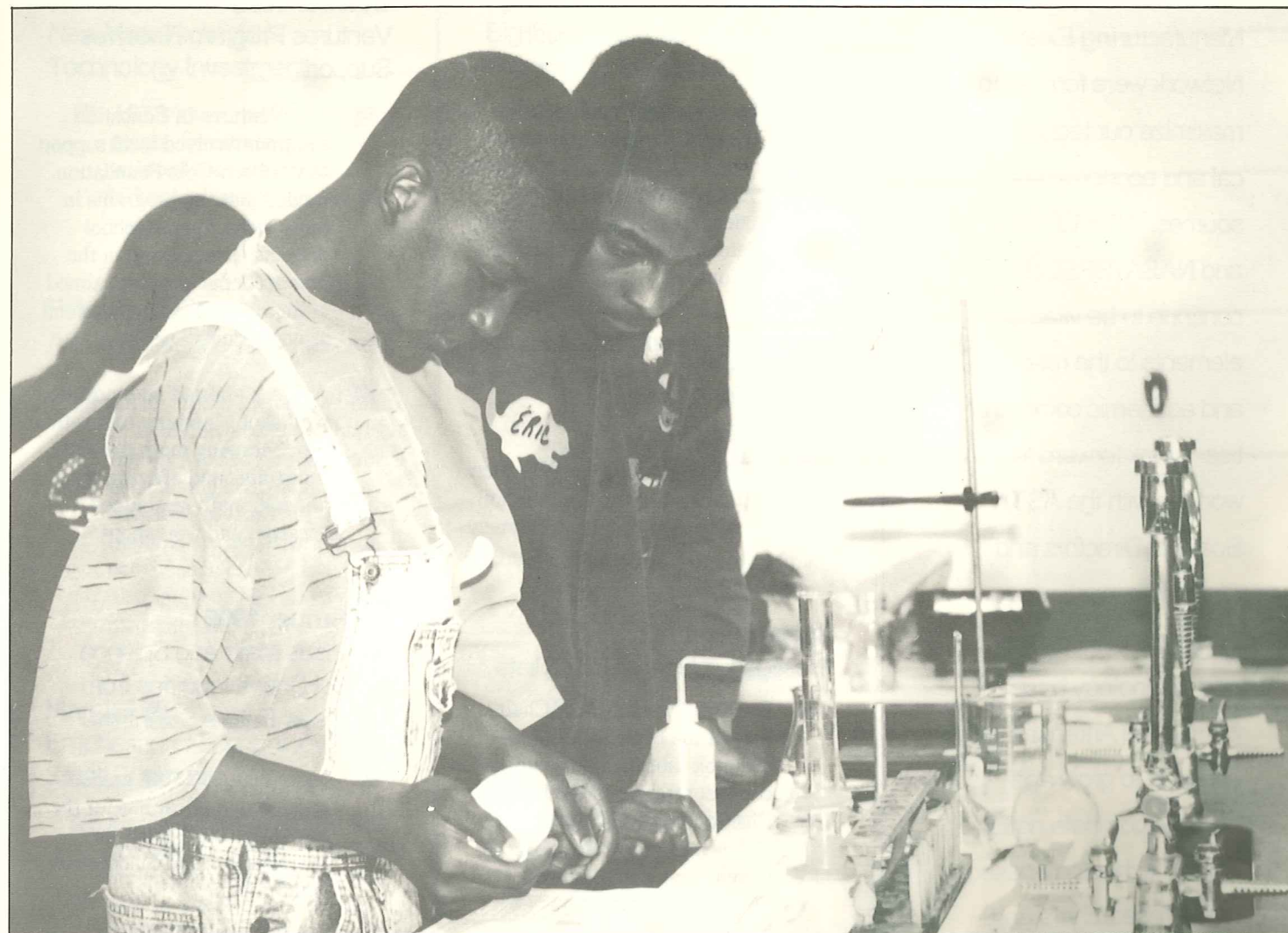
After one program year, students' grades and attitudes are a strong indication of the success of this project. By the end of the second program year, comparative data of students' performance and standardized tests will be available.

The Arkansas School for Mathematics and Science

In 1990, ASTA conducted a feasibility study for establishing a residential math and science high school in the state. The feasibility study was the basis for the authorization and funding of the school, which is located in Hot Springs.

A nine-member advisory board was established for the school and members include the President of the Science & Technology Authority, the Director of Higher Education (also an ASTA board member) and the Director of General Education.

By virtue of the advisory capacity in which staff and Board members have been called upon to serve, ASTA expects to have a long-standing working relationship with staff and supporters of the school.



Arkansas Ventures In Education Project Participation (1992/93 School Year)

Participating School District	Total Students Grades 9 - 12	Total Students Grade 10	Total No. of Students Enrolled in VIE 1st Yr.	Percentage of Students Enrolled in VIE 1st Yr.
Cross County	215	63	20	32%
Dumas	616	*308	*104	*34%
Lakeside	303	108	87	81%
Lee County	636	159	42	26%
Stuttgart	598	146	54	37%
TOTAL	2,368	784	307	39%

* These figures represent student populations in both the 9th and 10th grades. The Dumas School District enrolled students from both grades in the first year.

" In 1993, exciting new partnerships like the Memorandum of Understanding with NASA's Marshall Space Flight Center and our statewide Manufacturing Extension Network were formed to maximize our technological and economic resources. NSF/EPSCoR and NASA/EPSCoR continue to be vital elements to the research and academic communities. I look forward to working with the ASTA Board of Directors and Staff as we continue building a solid science and technology base from which Arkansas can continue to grow and begin to compete nationally for technology-based firms, researchers and funding."

Governor Jim Guy
Tucker, 1993

FY 1993 Highlights Recognitions, Events, and Affiliations

July 1992

Math and Science Education Program Launched

- The Arkansas Ventures In Education Program was introduced in the State of Arkansas as five school districts and 328 students in the Mississippi Delta Region completed first summer sessions.

August 1992

Support for Excellence in Education

- ASTA President John W. Ahlen participated in the Commission for Arkansas' Future: A Strategy for Excellence in Education.

September 1992

Prestigious Honors for Affiliate

- Dr. Karl David Straub, Chairman of the EPSCoR Committee, took sabbatical leave to conduct research at the Free-Electron Laser Laboratory at Duke University. Dr. Collis Geren, Co-Chair, assumed Dr. Straub's duties in his absence.
- ASTA awarded \$50,000 for its first energy-related technology development project.
- ASTA awarded \$212,570 in grant monies for eight Arkansas-based research projects.
- State funds went to support three state incubators considered to be ongoing and successful.

October 1992

Ventures Program Receives Support

- The Ventures In Education Program received local support as the Coca-Cola Foundation funded tutoring programs in those Delta Region school districts participating in the new academic program aimed at improving mathematics and science education.
- ASTA co-hosted an innovation workshop, "Making Innovation Pay," drawing more than 200 registrants and offering state and nationally-acclaimed speakers and workshops.

November 1992

Arkansas Math and Science School Draws Inquiries from Arkansas' Future Scientists

- More than 500 10th graders requested applications for the new Arkansas School for Mathematics and Sciences in Hot Springs.

December 1992

Investing in Little Rock - Based Technology

- ASTA invested \$50,000 in the Little Rock-based company, Intelc Systems, Inc., a re-seller and integrator of automatic identification and data collection systems that utilize bar coding technology.

January 1993

New Year Highlights Technology Investment

- ASTA awarded \$319,937 in grants, investments and traineeships to promote technological advances in the state.

February 1993

ASTA Board Member Honored

- ASTA Board member William C. Bridgforth received the 1993 Harvey McGeorge Award for outstanding contributions to Arkansas agriculture. ASTA is honored to have Board members of such caliber and distinguished service as part of its organization.

March 1993

Emphasis on Technology and Small Business

- President John W. Ahlen was extended an official invitation to the Nation's capital to participate in discussion about the SBIR Program, indicating the significance of technology and small businesses in the future of the U.S. economy.
- Chuck Myers, ASTA Vice President - Management Services, was guest speaker at Arkansas' High Tech Week, at SAU Tech, Camden. He discussed the state's need for a manufacturing technology extension to aid small manufacturing enterprises.

April 1993

Big Month for Technology Transfer

- ASTA President John W. Ahlen attended the White House Briefing on the Technology Reinvestment Project in Orlando, Florida.

May 1993

Promoting Careers in Science and Technology

- The Arkansas Science & Technology Career Expo was held at the University of Arkansas at Little Rock for high school students to increase their understanding of potential career choices in science and technology. In addition to UALR, nine other four-year state universities participated.

June 1993

Assisting Arkansas Companies to Acquire Technology

- ASTA became a statewide affiliate of the Mid-Continent Technology Transfer Center, enabling Arkansas companies to receive assistance from federal labs and regional and national technology transfer centers in acquiring, developing and applying various technologies.
- John W. Ahlen was invited to speak in Austin, Texas, at a regional Economic Development Agency conference.

Staff

John W. Ahlen, Ph.D.
President

James T. Benham
Vice President Finance

Joe P. Gentry, Ph.D., P.E.
Vice President Research

Chuck Myers
Vice President Management Services

Melissa Adams
Executive Secretary

Susan Collins
Project Administrator, VIE Project

Al Grijalva
Grants Coordinator

Jacqueline Klodt
Finance Program Manager

Mary Moon
Receptionist/Secretary

Brock Patterson
Finance Program Manager

Joyce Sadler
Project Administrator, EPSCoR

Janell M.Z. Sanders
Communications Manager

Ed Sartain
Fiscal Officer

Cassie Tavorn
Business Controller

Julie S. Welch
Research Program Manager

**Board of Directors,
Staff & Committees**

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Little Rock
Term expires: 1994

Jerry Webster, Vice Chairman
Webster Corporation
Little Rock
Term expires: 1995

Donald O. Pederson, Ph.D., Secretary
University of Arkansas
Fayetteville
Term expires: 1994

Joseph H. Bates, M.D.
McClellan VA Medical Center,
Little Rock
Term expires: 1995

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Ramsay, Bridgforth, Harrelson
& Starling Law Firm
Pine Bluff
Term expires: 1996

Diane S. Gilleland, Ph.D.
Department of Higher Education,
Little Rock
Term expires: Permanent

James V. Kelley
First National Bank of El Dorado
El Dorado
Term expires: 1995

Harry Truman Moore
Goodwin, Hamilton, Moore
& Colbert
Paragould
Term expires: 1993

Phillip L. Rayford, Ph.D.
University of Arkansas
for Medical Sciences
Little Rock
Term expires: 1997

John Troutt
Jonesboro Sun
Jonesboro
Term expires: 1995

William Willingham, Ph.D.
University of Arkansas
at Pine Bluff
Pine Bluff
Term expires: 1993

Ex-Officio Members

The Honorable Max Howell
Arkansas State Senate
Jacksonville
Term expires: 1993

The Honorable John Lipton
Arkansas House of
Representatives
Warren
Term expires: 1993

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Donald O. Pederson, Ph.D.
Phillip L. Rayford, Ph.D.
James V. Kelley

Research Committee
Phillip L. Rayford, Ph.D., Chair
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Arkansas Science & Technology
Authority

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University of Arkansas at Pine Bluff

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Tim O'Brien, Ph.D.
University of Arkansas for Medical
Sciences

Tom Goodwin, Ph.D.
Hendrix College

Cynthia Moten
Arkansas Department of Higher
Education

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Ouachita Baptist University

Gaylord Northrop, Ph.D.
University of Arkansas at Little Rock

Phil Price
Governor's Office

Dewey Sifford, Ph.D.
Arkansas State University

Joyce Sadler
EPSCoR

John Troutt
Jonesboro Sun

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Arkansas Science & Technology
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Beverly Dawkins Lyn-Cook, Ph.D.
National Center for Toxicological
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Arkansas State University

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Hendrix College

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University of Arkansas at Little Rock

Frank T. Orthoefer, Ph.D.
Riceland Foods, Inc.

Phillip Rayford, Ph.D.
University of Arkansas for Medical
Sciences

C. Dayton Steelman, Ph.D.
University of Arkansas, Fayetteville

Operating Statement
State Revenue and Expenditures
FY 1992 and 1993 (Ends 30 June)

	FY1992	FY1993
Revenue		
Revenue appropriation	\$1,497,579.00	\$1,519,186.00
Deferments	<365,816.00>	<329,666.00>
Net revenue allocation	\$1,131,763.00	\$1,189,520.00
Expenditures:		
Salaries	\$311,574.53	\$353,208.71
Employee benefits	67,203.85	79,160.76
Postage & delivery	3,778.10	4,935.50
Telephone & telex	63.30	63.30
Printing & duplicating	5,372.03	4,190.80
Office equipment maintenance	1,43.43	2,587.17
Office & equipment rent	46,705.10	48,597.68
Travel & sponsored meetings	14,117.79	14,990.12
Association dues & membership	10,841.00	12,282.83
Professional fees	9,205.19	4,133.11
Centrex phone services	6,909.57	7,593.83
Conference & convention fees	14,126.66	14,268.61
Insurance premiums	356.00	419.18
Stationery & office supplies	4,048.48	2,950.91
Subscriptions & publications	2,065.77	2,745.53
Software purchases	5,112.51	2,493.77
Equipment	2,825.82	4,760.78
Contract labor	3033.12	-0-
Total operating expenditures	\$508,822.25	\$559,382.59
Research grants/incubators	\$575,782.00	\$629,713.15
Project match	-0-	-0-
Total expenditures	\$1,084,604.25	\$1,189,095.74
Net revenue allocation	\$1,131,763.00	\$1,189,520.00
Less total expenditures	<1,084,604.25>	<1,189,095.74>
Unspent allocation	\$47,158.75*	\$424.26

*\$44,373 carry forward to FY 1993 for Basic & Applied Research Grants